Field work was supported by a cooperative aid agreement between the U.S.D.A. Forest Service, Pacific Southwest Forest and Range Experiment Station and the University of California at Riverside. I thank Kathryn A. Kramer for her help in the field and Jan van Wagtendonk for coordinating my work in Yosemite National Park. W. B. Critchfield, J. R. Griffin, J. C. Hickman, T. R. Plumb, and R. J. Vogl reviewed the manuscript and provided helpful comments.—Diana F. Tomback, Department of Zoology and Entomology, Colorado State University, Fort Collins 80523. (Received 2 Jan 1980; revision accepted 5 Sep 1980.)

Aggregation of *Prunus ilicifolia* (Rosaceae) during Dispersal and Its Effect on Survival and Growth.—Dispersing seeds are commonly aggregated at settlement, by vertebrates voiding cohorts of ingested seeds or storing seeds in caches, or by ants collecting and discarding seeds with elaiosomes. Aggregation may have significant consequences for seed and seedling survival and growth. For buried seed, aggregation may increase successful emergence (Linhart, J. Ecol. 64:375–380. 1976.). Seed predation may increase with cohort size (Wilson and Janzen, Ecology 53:954–959. 1972.) or decrease as aggregation lowers seed density over most of the dispersal region. Likewise, later herbivory might be increased or decreased. However, competition among aggregated seedlings surely must be greater than among widely scattered plants. None of these effects has been widely studied, perhaps for technical reasons or for lack of data on post-dispersal seed distributions.

In the California chaparral, seeds of *Prunus ilicifolia* are commonly dispersed by *Canis latrans,* with defecated and vomited cohorts containing 4–66 seeds (mean 23.5 ± 2.4 s.e., n = 34) in the central Santa Monica Mountains (1975, 1977, 1978), and 3–6 seeds at Chalone Peak, San Benito County (n = 4, 1974). This compares with seed cohorts of *Washingtonia filifera* dispersed by *Canis latrans* in eastern San Diego County, of 1–275 seeds (48.7 ± 3.1, n = 252: Bullock, Principles 24:29–32. 1980.). The endocarp/seed units of *Prunus* weighed 1.46 ± .04 g (n = 143), and *Washingtonia* seeds weighed 0.10 g (n = 50).

Experiments were conducted to observe survival and growth of *Prunus ilicifolia,* particularly with reference to aggregation of the seeds. Seeds were collected in the Santa Monica Mountains, and grown at the University of California, Los Angeles, in silty loam 25 cm deep resting on the natural substrate. The plants had only partial morning shade, and were watered only by rain. From December 1973 to November 1974, plants were grown in 1 × 2-m plots with 50 seeds each in four unreplicated conditions of interseed spacing: 20 cm, 10 cm, 5 cm, and 0 cm. Also in this year, cohorts (0 cm seed

Table 1. Survival from Seed to First-year Seedling and Mean Aboveground Dry Weight of Survivors (± s.e).

Aggregation	n	Survival	Biomass (g)
Seed spacing (cm)			
0	50 seeds	0.74	2.9 ± 0.5
5	50	0.64	6.1 ± 1.2
10	50	0.20	6.2 ± 1.5
20	50	0.22	1.4 ± 0.3
Seeds per cohort			
4	7 cohorts	0.79	14.9 ± 2.9
2	7	0.50	12.1 ± 2.3

FIG. 1. Graft between roots of two three-year-old plants of *Prunus ilicifolia*.

spacing) of 2 and of 4 seeds were grown (7 replicates each), spaced at 50 cm. From November 1974 to November 1977, plants were grown from cohorts of 1, 2, 3, 4, 5, 6, 8, 10 and 12 seeds (at least 9 replicates each), the cohorts spaced at 50 cm.

Both experiments of 1973–1974 showed greatest seedling survival in the most aggregated conditions (Table 1). This may be attributable to decreased desiccation during the summer, due to mutual shading. The mean above-ground biomass of survivors was greatest at intermediate densities in the uniform-spacing plots, but was much greater in the cohorts than in the spaced seedlings (Table 1). Apparently the full survival value of aggregation in these conditions was attained by only 4 seeds and massive aggregation reduced growth but not early survival.

From the 1974 planting, a harvest in November 1977 showed 89 percent survival from seed in cohorts of 1–8 seeds (n = 104 seeds, 32 cohorts), and 88 percent survival in cohorts of 10 and 12 seeds (n = 96 seeds, 9 cohorts). Biomass studies were not feasible but root diameters were measured on a subsample. Comparing cohorts of initial seed numbers of 1, 2–6, and 10 or 12, the total root cross-sectional areas were not significantly different between small, medium and large cohorts. However, the means for individual plants showed a sharp decrease across the three groups ($F'_s = 12.34$, $p < 0.01$), and more variability among isolated plants.

Grafting was commonly observed among individuals of a cohort (Fig. 1). Grafting was present in 12 of 30 cohorts with more than one survivor, and joined up to five plants. Grafting was most common near the surface and was distinct from the development of burls with multiple stems.

An interesting consequence of the high survival of cohort seedlings is that any physiognomic shrub may contain several genets, which may have had different female parents. The colonial shrub itself may be a small breeding neighborhood, and present some variety in all aspects of its ecological behavior. Furthermore, some direct physiological interaction among the genets may be possible due to grafting. The fate of individual plants in dispersal cohorts merits wider and closer attention.—STEPHEN H. BULLOCK, Botany Department, San Diego State University, San Diego, CA 92182. (Received and accepted 16 Oct 1980.)